Game Theory Applications in Refugee Crises

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The current Syrian refugee crisis is a massively complicated problem, involving millions of displaced people, multiple governments and insurgent groups, and daily horror for those displaced in the conflict (Schneider et al, 2017; Wofford et al, 2016). Each of these parties have vastly differing goals, resources, and ability to make decisions with global impact. Game theory, as a tool which analyzes situations in which multiple parties act in conflict, cooperation, and competition, is therefore a logical approach to the issue. What follows is an examination of the application of game theory approaches to past refugee crises, with the aim of elucidating what is available and what is lacking in the game theory toolset for dealing with this overwhelming problem.

The Theory of Moves (TOM) is an attempt to combine the time-sensitive aspect of classical extensive form games with the simplicity and brevity of normal form games. It presents game theory problems in the familiar payoff matrix of the more standard normal form, with the added provision that players are allowed to unilaterally change their strategy if doing so improves their payoff. Players then trade making such moves until a player opts to not make a unilateral move from an outcome in the matrix. The cell at which play stops is called the nonmyopic equilibrium (NME), and only when the NME is reached do players receive their new payoffs (Brams 1994, Kiryluk-Dryjska 2016).

Since TOM tries by its very mechanics to integrate bargaining and negotiation into game theoretic analysis, it is a natural tool to apply to questions of international relations in the context of refugee crises. A 1996 study by Zeager and Bascom is an early attempt at doing so, with some promising results. Rather than attempting to take on modeling a refugee crisis in its entirety--the authors rightly point out that refugee issues are so complicated as to be difficult to accurately model holistically--the study focuses instead on the negotiation dynamics that might lead to repatriation of a refugee population.

Zeager and Bascom consider the refugees' country of origin (CO) and the United Nations High Commission on Refugees (UNHCR) as their game's two players. One major assumption implicit in this selection is that the UNHCR effectively represents all the interests of the refugees, the

TABLE 1

Nonstrategic Repatriation: A Sympathetic Government and Sympathetic Donors

| COUNTRY OF ORIGIN | UNHCR: Assist | UNHCR: Don't Assist |
|---|---|---|
| Repatriate | A (4,4) | B (3,3) |
| Don't Repatriate | C (2,2) | D (1,1) |

NOTE: Key: (x, y) = (rank ordering for country of origin, rank ordering for UNHCR). 4 = best, 3 = next best, 2 = next worst, 1 = worst.

*Table 1 from Zeager and Boscom 1996*

country of asylum that refugees have fled to, donor countries responsible for funding UN action, as well as the interests of the UN itself. This is clearly a far-reaching assumption, and one which the authors acknowledge is made in the interest of simplifying the analysis. Each player is given complete control over a single choice, such that CO can choose to either allow repatriation or deny it, and UNHCR can either provide assistance or not.

The first game considered in Zeager and Bascom's paper (pictured above) is the simplest. Both CO and UNHCR have identical ordinal rankings for the possible outcomes. The authors liken this model to a scenario in which an oppressive regime at odds with the refugees' politics has recently been toppled, and a new government, sympathetic to the refugee population, has been erected in its place. Since the rankings are identical for both parties, the authors consider this scenario to be *nonstrategic*--that is, both parties will agree to their mutually preferred outcome right off the bat. As a result, TOM cannot be applied, as one strategy clearly dominates for both players.

In contrast, the next model (pictured right) considers a negotiation between UNHCR a hostile CO. Here, UNHCR maintains its ordinal rankings: it prefers most to provide assistance and see the refugee population repatriated; next, that refugees repatriate even without funding (as this aligns with UNHCR's guiding mission); then, that assistance is provided even without repatriation (for the good of the refugees); and lastly that neither repatriation nor assistance is provided. By contrast, CO, which actively does not want the refugees repatriated, exhibits the following ordinal ranks: first, that the refugees are neither repatriated nor assisted; next that they are not repatriated even if they might receive assistance (the government's goal is more about keeping the refugees outside its borders than whether they receive aid); then that they are repatriated with financial assistance from UNHCR (since at least that money will boost the local economy); and lastly that the refugees repatriate with no assistance.

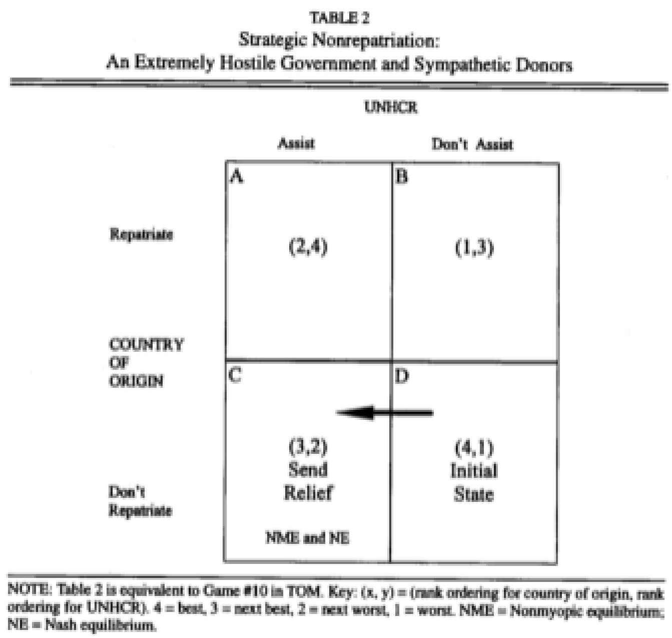
TABLE 2
Strategic Nonrepatriation:
An Extremely Hostile Government and Sympathetic Donors

| COUNTRY OF ORIGIN \ UNHCR | Assist | Don't Assist |
| --- | --- | --- |
| Repatriate | A (2,4) | B (1,3) |
| Don't Repatriate | C (3,2) Send Relief NME and NE | D (4,1) Initial State |

NOTE: Table 2 is equivalent to Game #10 in TOM. Key: (x, y) = (rank ordering for country of origin, rank ordering for UNHCR). 4 = best, 3 = next best, 2 = next worst, 1 = worst. NME = Nonmyopic equilibrium; NE = Nash equilibrium.

*Table 2 from Zeager and Boscom 1996*

Since the ordinal rankings are quite opposed between the two parties in this scenario, a strategic analysis is warranted. The next step in the TOM framework is to create a sequence of possible unilateral moves from some assumed starting condition. In this case, the starting condition is assumed to be cell D in Table 2--in order for refugees to be considered as such, they must have already been forced from their CO, and UNHCR is assumed to not yet have issued any aid. The sequence of possible moves is either a complete clockwise or counterclockwise traversal of the table, depending on who makes the first move. Here it makes more logical sense for the UNHCR to make the first move, as the government is assumed to be hostile toward the refugees. Thus the sequence of moves is:

$$(4,1) \rightarrow (3,2) \rightarrow (2,4) \rightarrow (1,3) \rightarrow (4,1)$$

In the next portion of analysis, the concept of backwards induction is borrowed from traditional extended form analysis, as we work backwards through each potential move and ask if the player would make the move, given any subsequent moves that could be taken from there. In this case, the last move in the sequence is CO opting to move the outcome from cell B to cell D, and shifting the payoffs from (1,3) → (4,1). Since cell D, with a payoff of (4,1) is CO's most preferred payoff, we can assume they would make the move. Next, we look at the second-to-last move, UNHCR moving (2,4) → (1,3). Knowing that CO will go ahead with the next move, should the UNHCR make this second-to-last move? The answer is clearly no, as UNHCR's outcome decreases in both the immediate result of the move and, more importantly, in the end result of the game.

This process is repeated for each preceding move: CO would not opt to move from (3,2) → (2,4), but UNHCR would make the very first move of (4,1) → (3,2), since (3,2) is a preferable outcome to (4,1) for them, and they know that CO will not make the subsequent move. Therefore, the solution to the game is cell C, (3,2). In writing the analyzed sequence, bars are added to indicate moves that would not be chosen, so that the sequence would then appear:

$$(4,1) \rightarrow (3,2) \rightarrow |(2,4) \rightarrow |(1,3) \rightarrow (4,1)$$

The analysis shifts if we assume the other party makes the first move, but the technical approach remains the same. For the situation in which CO makes the first move, the sequence comes out as:

$$(4,1) \rightarrow |(1,3) \rightarrow |(2,4) \rightarrow (3,2) \rightarrow |(4,1)$$

The solution in this case would be (1,3): CO by definition is making the first move, but UNHCR would not move away from (1,3) to the tempting (2,4), as it knows CO would then take the game to the less desirable (3,2). Since a solution of (1,3) is less advantageous from the perspective of CO than the first solution of (3,2), CO should wait for UNHCR to make the first move. The outcome of the game, therefore, is assistance without repatriation, and this solution is at nonmyopic equilibrium, as well as at Nash equilibrium.

Recognizing that the assumptions made in the above analysis may be overly simplistic, particularly in situations where the UNHCR's goals may differ significantly from those of what have thus far been considered to be its constituent stakeholders, Zeager (1998) has attempted to expand the approach outlined above. Here, three players are considered: CO, UNHCR, and the country of asylum (CA). As before, each party has total control over just one choice. Again, CO can either allow repatriation

TABLE 1. Possible Agreements That Could Emerge from Negotiations Among a Country of Origin, a Country of Asylum, and UNHCR

| | | Country of Asylum | | | |
|---|---|---|---|---|---|
| | | S | | $\bar{S}$ | |
| | | UNHCR | | UNHCR | |
| | | A | $\bar{A}$ | A | $\bar{A}$ |
| Country of Origin | R | SRA | $SR\bar{A}$ | $\bar{S}RA$ | $\bar{S}R\bar{A}$ |
| | $\bar{R}$ | $S\bar{R}A$ | $S\overline{RA}$ | $\overline{SR}A$ | $\overline{SRA}$ |

*Notation:*
S: Permit Settlement; $\bar{S}$: Deny Settlement
R: Permit Repatriation; $\bar{R}$: Deny Repatriation
A: Provide Assistance; $\bar{A}$: Withhold Assistance

*Table 1 from Zeager 1998*

or deny it, and UNHCR can either provide financial assistance or not. CA is given the choice to either allow refugees to settle in their country, or not.

Going from a two to a three person game massively complicates things. Zeager's method for keeping the analysis manageable is to assume information is only obtained by players as it is revealed by opponents, unlike in the simpler TOM game described above. In this way, an analysis can elucidate a path for negotiations as the game is played out.

As before, all possible outcomes can be displayed as a set of tables (pictured above)--however, two are required, as the addition of a third player cannot be clearly indicated in a single two-dimensional 2x2 traditional table. Presented with the set of all possible outcomes, each player makes a series of judgements as to its primary, secondary, and tertiary goals. The primary goal indicates the top four preferred outcomes out of the eight possible, the secondary goal specifies the two preferred outcomes out of those four, and the tertiary goal defines the most desired outcome between those two. In the study in question, the researchers were attempting to model the Rwandan refugee crises in the 1980s and 1990s. With reference to Rwandan refugees living in exile, they assume Rwanda to be a hostile CO and Burundi to be a sympathetic CA. UNHCR is considered sympathetic as well, albeit with a divergent set of goals from those of Burundi.

The primary, secondary, and tertiary goals determine ordinal rankings for each possible outcome, which are then plotted along with an impasse point for each player, where the player would prefer no agreement at all to an outcome ranked lower than the impasse:

TABLE 2. Rank Orderings of Outcomes by the Players: The Case of Rwandese Tutsis in Burundi

| | *Rank Ordering of Outcomes* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Player* | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| CO | $\overline{SRA}$ | $S\overline{RA}$ | $\overline{SR}A$ | $S\overline{R}A$ | I | $\overline{S}R\overline{A}$ | $SR\overline{A}$ | $\overline{S}RA$ | SRA |
| CA | SRA | $S\overline{R}A$ | $SR\overline{A}$ | $S\overline{RA}$ | I | $\overline{S}RA$ | $\overline{SR}A$ | $\overline{S}R\overline{A}$ | $\overline{SRA}$ |
| UN | SRA | $SR\overline{A}$ | $\overline{S}RA$ | $\overline{S}R\overline{A}$ | $S\overline{R}A$ | $S\overline{RA}$ | I | $\overline{SR}A$ | $\overline{SRA}$ |
| | *Resulting State* | | | | | | | | |
| | I | I | I | I | $S\overline{R}A$* | | | | |

*Players:*
CO: Country of Origin
CA: Country of Asylum
UN: United Nations High Commissioner for Refugees

*Strategies:*
S: Permit Settlement; $\overline{S}$: Deny Settlement
R: Permit Repatriation; $\overline{R}$: Deny Repatriation
A: Provide Assistance; $\overline{A}$: Withhold Assistance

*Goals of the Players:*
CO: (1) Deny Repatriation; (2) Withhold Assistance; (3) Deny Settlement
CA: (1) Permit Settlement; (2) Provide Assistance; (3) Permit Repatriation
UN: (1) Permit Repatriation; (2) Permit Settlement; (3) Provide Assistance

*Other Notation:*
9 = best, 8 = next best, . . . , 2 = next worst, 1 = worst
I: Impasse in Negotiations

*Denotes the predicted outcome under unanimity

*Table 2 from Zeager 1998*

As mentioned previously, this model assumes each player to have incomplete knowledge regarding the other players' outcome preferences before they are revealed. The game proceeds with a series of negotiations, starting at the left end of the table with the players' maximally preferred outcomes. A solution can only be reached by unanimous decision or by impasse, as each player has complete control over the decision within their domain and can thus veto any unsatisfactory outcome.

Clearly there is no unanimous decision after all players have revealed their first choice outcome in the first round of negotiation. Their choice then is to either continue to the second round, or accept an impasse. Since for all players many outcomes still remain that would be preferable to an impasse, the players will continue to the second round of negotiation, and more information will come to light as the players reveal their second choice outcome. Another way to look at this point in the game is that each player is willing to compromise their favorite outcome, rather than accept an impasse. If a player was unwilling to get any less than all their demands, an impasse would be their second-ranked outcome.

The game continues in this manner. By the end of the fourth round, all players will have revealed their first four preferred outcomes, with CA and CO each being willing to accept two compromises: one in which refugees are provided resettlement by CA, denied repatriation by CO, and provided assistance by UNHCR, and one in which refugees are allowed by CA to settle, but denied both repatriation and assistance. However, negotiations will continue, as UNHCR is still attempting to hold out for its primary goal of repatriation.

It is only in the fifth round of negotiation that UNHCR capitulates and reveals its willingness to accept an outcome in which refugees are denied repatriation, but provided the option to settle in CA and receive aid. Since this is one of the acceptable outcomes previously revealed by the other two players, a unanimous solution is reached.

In addition to this model fitting the historical facts of the Rwandan situation well, it provides some interesting prescriptive power. For example, a reprioritization by UNHCR in which settlement rather than repatriation becomes the primary goal would cause the model to provide two outcomes found to be acceptable for all parties. Zeager points out that in this case, a useful role that UNHCR could fill would be that of tie-breaker, as the UN would presumably already be acting in some facilitative capacity throughout the negotiations.

Caveats should be made regarding game theory models like those described here. As previously mentioned, the facts of a situation as complex as the Rwandan or Syrian refugee crisis are slippery at best, and unknowable at worst. Enormous pains must be taken to synthesize in-depth qualitative and quantitative data to ground solid models. Likewise, the models featured above are complex and not necessarily well agreed upon--for example, at least one objection has been raised in the literature as to whether the Theory of Moves is an actually distinct and useful tool, as opposed to simply a rearrangement of classical game theory (Stone, 2001).

As a final note, it is important not to lose sight of the human element when modeling. In an attempt to strictly model negotiation, the authors summarized here make exogenous the motivations and actions of refugees themselves. This is done with complete self awareness, and grounding in the literature: in justifying his decision to exclude refugee viewpoints from his analysis, Zeager cites Hamburger (1979) when defining a player as both having an interest in and an ability to affect a game's outcome. But might this not be problematic? Even putting aside the humanistic argument that we should not exclude from a model those being most brutally affected by the problem at hand, is it true that refugees lack interest in and an ability to affect negotiation outcomes? As Stein and Cuny (1994) point out, "The refugees themselves are the main actors in contemporary forms of voluntary repatriation. They are the main decision-makers, and they determine how they will move…although refugees are commonly thought of as powerless...the decision to flee, or to stay, or to return home is itself an action and a choice." It is worth asking whether we can use these models of refugee repatriation to help create a framework in which refugees' goals and motivations can have real impact on the determination of their fate.

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